AD-A132 694 FIBER COUPLED HIGH TEMPERATURE GAA1AS LASER DIODE 1/1
ASSEMBLIES(U) LASER DIODE LABS INC NEW BRUNSWICK NJ
J S MENNELLA 31 MAR 80 DAAK70-78-C-0116

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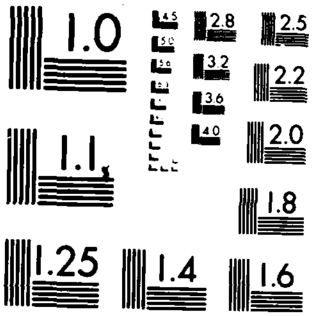

MICROCOPY RESOLUTION TEST CHART
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AD-A132694

CONTRACT #DAAK70-78-C-0116

FIBER COUPLED, HIGH TEMPERATURE GaAlAs
LASER DIODE ASSEMBLIES

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31 March 1980

FINAL REPORT

Prepared For:

Director
Night Vision/Electro-Optics Laboratory
ATTN: DELNV-L(PAUL)
Fort Belvoir, VA 22060

DISTRIBUTION STATEMENT A
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SUMMARY

Work performed under this modification was designed to establish techniques for selecting diode material, process fabrication and testing methods for GaAlAs fiber coupled diodes. The work involved building 100 diodes capable of meeting or exceeding the specifications in Table I. Forty of the diodes would be passivated with Al_2O_3 and an additional forty lasers would have index matching jel applied to the front facet. The remaining twenty devices would be left uncoated and used as controls.

A

Material Structure

Several seven layer LOC structure wafers were grown using the in-house liquid phase epitaxial reactors. Substrate material selected was low dislocation density single crystal GaAs grown at LDL by the horizontal gradient freeze technique.

Substrate material of (100) orientation was lapped and polished, and cleaved to size for the graphite boat used for the epitaxial growth. A seven layer structure was grown on the substrate:

Layer 1: GaAs Buffer
Layer 2: $Ga_{1-W}Al_WAs$ N-Barrier
Layer 3: $Ga_{1-X}Al_XAS$ N-Optical Cavity
Layer 4: $Ga_{1-Y}Al_YAs$ P-Active (Y for 8355 nm)
Layer 5: $Ga_{1-Z}Al_ZAs$ P-Barrier
Layer 6: GaAs P-Cap
Layer 7: GaAs N-Isolation
$Z > W > X > Y$

Grown wafers were cleaved and layer thicknesses measured before any processing was attempted. Wafers deemed to have the proper layer thicknesses were then subjected to the processing required to generate the diodes.

Diode Fabrication

Selected wafers were first sent to photolithography. Here the material was cleaned and, using photo resist techniques developed for CW lasers, stripes 3 mils wide applied to the surface. The material was etched in order that the 3 mil stripe extended through the isolation layer and into the cap layer. This opened a 3 mil contact area in the wafer.

After the stripes were etched into the wafer, it was stripped of photo resist and waxed to a lapping fixture. The substrate was lapped to a final thickness between 3-4 mils. After lapping ohmic contacts were applied to both N and P sides. The stripe windows allowed ohmic contact only in the area defined by the stripe.

The wafer was next cleaved into ~ 10 mil bars. Cleaving is perpendicular to the direction of the stripes. Cleaved bars were loaded in an evaporation fixture and a reflecting mirror was evaporated on to one side of the facet. The mirror allows all the light to be emitted from the front facet and eliminates rear facet light from being reflected by the back of the package.

Individual pellets were formed by waxing the cleaved bars on a cutting fixture and cutting the bars into pellets by cutting between the stripes. The final die configuration is 3-4 mils high, 10 mils deep and ~ 11 mils wide with the stripe in the center of the pellet.

Ten to twenty lasers were fabricated from each wafer for evaluation. The lasers were mounted on TO-18 packages and tested at both room temperature and at 55°C. I_{th}, P_o and wavelength were measured to insure the wafer would meet the requirements of Table 1. Far field patterns were checked and the stripe dimension was measured.

The best wafer meeting all of the requirements of Table 1 was selected and the entire wafer was processed into pellet using the above processing techniques. Sufficient diodes were built to insure 100 pieces for the program. One hundred diodes were selected and screened to insure they met all of the requirements

in Table 1.

Tested diodes were optically examined to insure there was no facet damage introduced during screening and testing. Twenty diodes were capped and numbered 1-20. These diodes would serve as the control lot. Forty diodes were loaded in an evaporation fixture and a 1/2 λ coating of Al_2O_3 coating was applied to the facet. The devices were retested to insure no damage was intoduced during the evaporation process. They were again subjected to optical inspection and then capped. These devices were numbered 21-60.

The forty remaining devices had index matching jel applied to the facet. After the jel was cured all devices were again tested and inspected prior to capping. These devices were numbered 61-100.

Test Program

Devices were again tested both at room temperature and at 55°C. Data was recorded to serve as a base line for all tests. Beam patterns were also checked to insure there were no changes due to the cap windows or passivation materials. No changes were noted and work continued according to the test program.

All diodes were placed in an oven at 150°C ± 5° for 48 hours. Devices were removed and allowed to cool. Data was taken and recorded. No change in output power was noted when devices were each driven at I_m both at room temperature and 55°C.

Devices were sent to AEL for temperature cycle testing. (Testing report attached.) Returned diodes were again driven at I_m at both room temperatures and 55°C, P_o data was recorded and again no changes in power were seen. Devices were again

optically inspected to insure pellet integrity. There was no evidence of any damage. Beam patterns were again checked at this point and no abnormalities were noted.

Devices were then placed on burn-in. Each position was numbered. Currents were set at I_m, room temperature, for each diode and pulse width and rep rate were checked. Diodes were put into their numbered position and burned-in for 17 hours. At the completion of 17 hours the rack was turned off and the diodes removed. Data was again recorded for both room temperature and 55°C. Devices were optically inspected and beam profiles checked. Some changes in P_o were noted. The control lot exhibited greater change than any of the lots with coated facets. Al_2O_3 coated facets show most stability. No evidence of facet errosion is noted and profiles seem unchanged.

All lasers were returned to the burn-in rack and operated for 100 hours at I_m. At the end of one hundred hours the devices were removed and retested. Data was recorded and ΔP_o was calculated at both room temperatures and 55°C.

Both the control lot and the lot with the index matching jel showed a large degree of change. The lot with the jel showed an even higher insidence of failure then the control lot. Failure being defined as a $\Delta > 20\%$.

Optical inspection did not reveal any facet errosion and beam patterns were still good for all devices. There were some areas of no light on the devices with Δ's $> 20\%$.

Most of the devices passivated with Al_2O_3 showed no change in P_o. Those that showed some degree of change all had Δ's less than 10%. They showed no evidence of facet errosion

or beam distortion. Junctions showed no evidence of unlit areas.

In all instances where there was some change in power during life test the Δ was almost the same for both room temperature and 55°C.

All devices were now tested at the lower rep rate and wider pulse width of Table 2. Data was recorded and a new I_m determined. Three of the control lot devices could not be returned to the minimum P_o without exceeding the I max. These devices were driven at I max and data recorded under these conditions. Lasers were again subjected to optical inspection and no facet errosion was noted.

Burn-in racks were reset for the new I_m and the pulse width and rep rate adjusted according to Table 2. Lasers were put into their numbered positions and burned in for 17 hours. At the end of 17 hours the racks were turned off and the devices removed. All devices were tested and data recorded. No changes were noted in P_o indicating the devices had already been stabilized by the prior operations. No facet errosion was noted and there was no change in beam profile.

Devices were returned to the burn-in rack and life tested for 100 hours. Lasers were removed from the rack and retested. Again, both uncoated and jelled lasers showed the greatest changes. Lasers with Al_2O_3 coatings were almost all unchanged. Deltas for the few Al_2O_3 coated lasers which had changed were all less than 10%. The few lasers in the control lot which showed no change during the first series of tests also showed no change during the second test series. Some slight evidence of facet errosion

was detected in both the control lot and the lot with the index matching jel. Beam patterns were still good for all lots.

It will be noted that some lasers did not complete all the tests. These lasers were accidently destroyed by handling during testing and not as a result of the tests. A total of 18 lasers from both the control lot and lot with index matching jel could not be brought to 300 mw at I max. At the end of all tests these showed the greatest amount of facet errosion or non lasing areas along the facet. All the Al_2O_3 coated lasers were well within specifications at the end of all tests.

Conclusions

It has been shown that lasers passivated with Al_2O_3 show a far greater stability to long term degradation and facet errosion then lasers left uncoated or lasers using only an index matching jel on the facet. As a result of these tests, twenty five lasers were fabricated using pellets from the wafer selected for the above tests. The lasers were built according to Figure 1. The lasers were subjected to all of the test conditions in Table 2 and met all the requirements of Table 1 before and after testing. The devices were delivered to the Night Vision Labs. A copy of the data is attached, along with a copy of the test report from AEL.

All delivered devices performed as the Al_2O_3 coated lasers in the test program.

TABLE I

Fiber: 0.0035 ± 0.0005 inch core 0·375 ± 10 inch long glass on glass

Lasers: $P_o > 300$ mw @ F2.5

Pulse width @ 50% points $\geq$ 65 nsec

Rep Rate = 10KHZ

Temp.	I_{max}	P_o (Min)
25 ± 2°C	7A	300 mw
55 ± 4°C	10A	300 mw

λ 850^{+10}_{-20} nm @ 25°C

Burn-in 17 hours @ I_m, 25°C, 65 nsec, 10 KHZ

Lifetime > 100 hours Δ <20%

High Temperature Storage: 48 hours @ 150°C

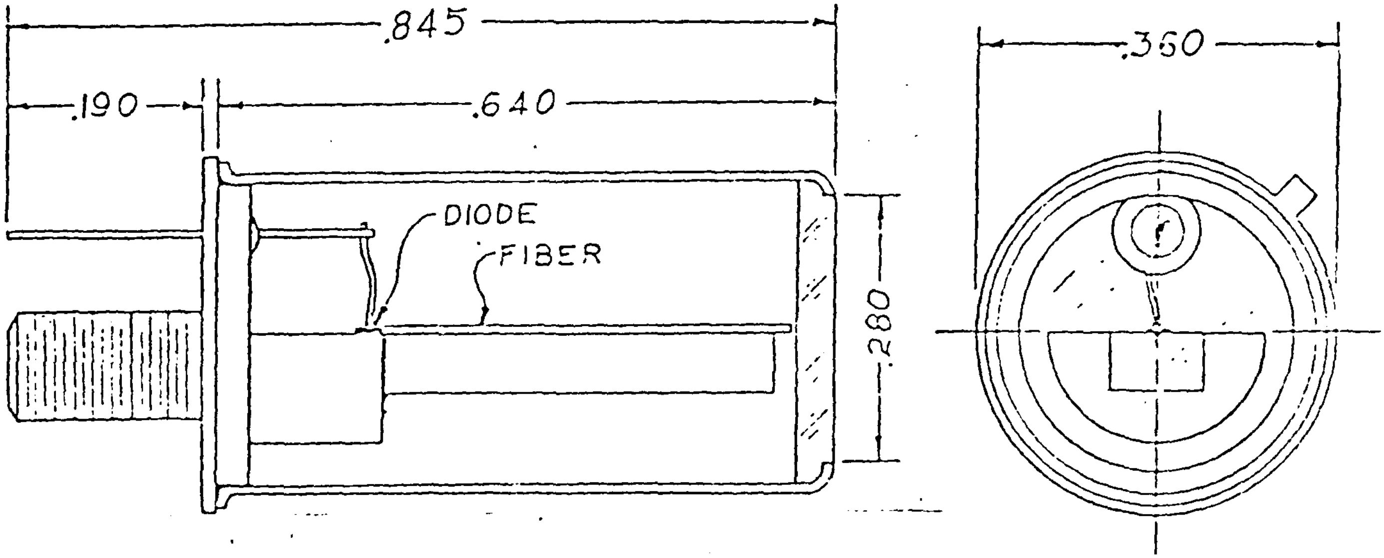
Temperature Cycling: MIL-STD-202, Method 102, Condition B
100°C

TABLE 2

TEST PROGRAM

1. Characterize Lasers @ 25°C, 55°C record I_m, P_o observe Beam Profile
2. High Temperature Storage and Thermal Cycling as per Table 1
3. Characterize as in 1
4. Burn-in as in Table 1
5. Characterize as in 1
6. Life Test for 100 hours as per Table 1
7. Characterize as in 1
8. Characterize lasers as in 1 but pulse width $\geq$ 75 ns, rep rate = 5 KHZ
9. Burn-in for 17 hours as per 8
10. Characterize as per 8
11. Life Test 100 hours as per 8
12. Characterize as per 8

Figure 1.



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DATE:

APPROVED BY

DRAWN BY

DRAWING NUM

I

		Pre Burnin				Pre Condition							
	Q 6080	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 15ns 10KHZ	P_{om} @ I_m 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	High Temp Storage 48 hrs @ 150°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 65ns 10KHZ	P_{om} @ I_m, 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	Temp. Cycle Mil Stan 202 med 102 100°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C 65ns 10KHZ
		mw	Amps	mw	Amps	P/F	mw	Amps	mw	Amps	P/F	mw	Amps
DATE													
TIME													
1		326	6	326	7	P	326	6	326	7	P	326	6
2		367	3	449	4		326	3	449	4		367	3
3		306	3	408	4.5		306	3	408	4.5		306	3
4		326	4	326	5		326	4	326	5		326	4
5		326	5	306	6		326	5	306	6		326	5
6		326	4	408	5		326	4	408	5		326	4
7		326	4	408	5		326	4	408	5		326	4
8		408	5	410	5		408	5	410	5		408	5
9		408	6	408	7		408	6	408	7		408	6
10		326	3	449	4		326	3	408	4		326	3
11		408	3	490	4		408	3	490	4		408	3
12		490	3	367	3		490	3	367	3		490	3
13		367	6	326	6		367	6	326	6		367	6
14		326	5	408	6		326	5	408	6		326	5
15		367	4	326	4		367	4	326	4		367	4
16		408	3	326	3.5		408	3	326	3.5		408	3
17		326	4	321	4		326	4	326	4		326	4
18		408	4	326	4		408	4	326	4		408	4
19		367	5	326	5		367	5	326	5		367	5
20		326	6	326	7		326	6	326	7		326	6
21		367	5	408	6		367	5	408	6		367	5
22		530	4	367	4		530	4	367	4		530	4
23		449	3	367	3		449	3	367	3		449	3
24		408	4	306	4		408	4	306	4		408	4
25		326	5	326	7		326	5	326	7		326	5
26		300	6	300	7		300	6	300	7		300	6
27		326	4	388	5		326	4	388	5		326	4
28		367	3	408	4		367	3	408	4		367	3
29		326	7	306	7		326	7	306	7		326	7
30		326	4	367	5	↓	326	4	367	5	↓	326	4
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Q 6080		Pre Burnin				Pre Condition							
		P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 65ns 10KHZ	P_{om} @ I_m 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	High Temp Storage 48hrs @ 150°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 65ns 10KHZ	P_{om} @ I_m, 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	Temp. Cycle Mil Stan 202 med 102 125°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C 65ns 10KHZ
		mW	Amps	mW	Amps	P/F	mW	Amps	mW	Amps	P/F	mW	Amps
DATE													
TIME													
61		428	4	326	4	P	428	4	326	4	P	428	4
62		367	4	449	5		367	4	449	5		367	4
63		410	4	367	4		410	4	367	4		410	4
64		326	4	408	5		326	4	408	5		326	4
65		449	4	405	4.5		449	4	408	4.5		449	4
66		367	3	469	4.5		367	3	469	4.5		367	3
67		408	4	367	5		408	4	367	5		408	4
68		449	4	367	5		449	4	367	5		449	4
69		408	4	367	5		408	4	367	5		408	4
70		408	3	470	4		408	3	490	4		408	3
71		326	3	406	4		326	3	406	4		326	3
72		449	4	326	4.5		449	4	326	4.5		449	4
23		408	5	367	6		408	5	367	6		408	5
74		430	3	367	3.5		430	3	367	3.5		430	3
75		449	4	326	4		449	4	326	4		449	4
76		571	4	326	4.5		571	4	326	4.5		571	4
77		306	7	300	7		306	7	300	7		306	7
78		347	4	408	5		347	4	408	5		347	4
79		326	3	367	4		326	3	367	4		326	3
80		428	3	326	3.5		428	3	326	3.5		428	3
81		306	3	367	4.5		306	3	367	4.5		306	3
82		408	4	367	4		408	4	367	4		408	4
83		326	3	410	4		326	3	410	4		326	3
84		449	4	428	5		449	4	428	5		449	4
85		490	4	367	4		490	4	367	4		490	4
86		367	3	447	4		367	3	449	4		367	3
87		410	5	326	5		410	5	326	5		410	5
88		449	5	410	6		449	5	410	6		449	5
89		449	3	326	3		449	3	326	3		449	3
90		408	3	408	4	↓	408	3	408	4	↓	408	3
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	Q6080	Pre Burnin				Pre Condition							
		P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 15ns 10KHZ	P_{om} @ I_m 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	High Temp Storage 48hrs @ 150°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 65ns 10KHZ	P_{om} @ I_m, 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	Temp. Cycle Mil Stan 202 med 102 100°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C 65ns 10KHZ
		mw	Amps	mw	Amps	P/F	mW	Amps	mw	Amps	P/F	mW	Amps
DATE													
TIME													
31		367	4	347	5	P	367	4	347	5	P	367	4
32		367	3	449	4		367	3	449	4		367	3
33		490	4	367	4		490	4	367	4		490	4
34		449	4	367	4		449	4	367	4		449	4
35		306	7	306	7		306	7	306	7		306	7
36		408	4	306	4		408	4	306	4		408	4
37		408	3	490	4		408	3	490	4		408	3
38		408	6	306	6		408	6	306	6		408	6
39		408	6	347	7		408	6	347	7		408	6
40		326	5	300	7		326	5	300	7		326	5
41		306	5	347	6		306	5	347	6		306	5
42		530	3	367	3		530	3	367	3		530	3
43		408	5	347	4		408	5	347	4		408	5
44		367	4	326	5		367	4	326	5		367	4
45		326	6	306	7		326	6	306	7		326	6
46		326	6	306	6		326	6	306	6		326	6
47		510	4	408	4.5		510	4	408	4.5		510	4
48		448	4	367	4.5		448	4	367	4.5		448	4
49		408	5	347	5		408	5	347	5		408	5
50		469	4	408	5		469	4	408	5		469	4
51		408	5	347	5		408	5	347	5		408	5
52		408	3	490	4		408	3	490	4		408	3
53		326	6	326	5.5		326	6	326	5.5		326	6
54		448	4	367	4		448	4	367	4		448	4
55		408	4	306	4		408	4	306	4		408	4
56		367	6	326	6.5		367	6	326	6.5		367	6
57		449	5	410	5.5		449	5	410	5.5		449	5
58		306	7	300	7		306	7	300	7		306	7
59		326	6	408	7		326	6	408	7		326	6
60		408	3	449	4	↓	408	3	449	4	↓	408	3
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C 6080

		Pre Burnin				Pre Condition							
		P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 65ns 10KHZ	P_{om} @ I_m 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	High Temp Storage 48 hrs @ 150°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C, 65ns 10KHZ	P_{om} @ I_m, 65ns, 10KHZ F2.5 55°C	I_m @ 55°C, 65ns 10KHZ	Temp. Cycle Mil Stan 202 mcd 102 125°C	P_{om} @ I_m 65ns, 10KHZ F2.5 25°C	I_m @ 25°C 65ns 10KHZ
		mw	Amps	mw	Amps	P/F	mw	Amps	mw	Amps	P/F	mw	Amps
DATE													
TIME													
91		408	4	326	4	P	408	4	326	4	P	408	4
92		326	3	408	5		326	3	408	5		326	3
93		367	4	367	6		367	4	367	6		367	4
94		306	7	300	7		306	7	300	7		306	7
95		490	3	530	4		490	3	530	4		490	3
96		469	4	326	4		469	4	326	4		469	4
97		510	4	449	4		510	4	449	4		448	4
98		367	3	408	4		367	3	408	4		367	3
99		367	4	428	5		367	4	428			367	4
100		510	4	490	5	↓	510	4	490	5	↓	510	4
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Note: Diodes: 1-20 Bare Diodes

Diodes: 21-60 Al_2O_3 on Facets

Diodes: 61-100 Jel on facets

II.

		Pre Condition		Post Burn in				Life Test				Δ	
		P_{om} @ I_m 65ns, 10KHZ F 2.5 55°C	I_m @ 55°C, 65ns 10KHZ	P_{om} @65ns, 10KHZ F2.5 25°C After 17 Hr Burn In	I_m @ 25°C After 17 hr Burnin	P_{om} @I_m, 65ns, 10KHZ F 2.5 55°C After 17 hr Burnin	I_m @55°C After 17hr Burnin	P_{om} @ I_m 65ns, 10KHZ F 2.5 25°C After 100 hrs	I_m @25°C After 100hrs	P_{om} @ I_m 65ns, 10KHZ F 2.5 55°C After 100 hrs	I_m @ 55°C After 100 hrs	Δ P_{om} @ 25°C After Life Test max Δ 20%	Δ P_{om} @ 55°C After Life Test max Δ 20%
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	%	%
DATE													
TIME													
1		326	7	326	6	326	7	306	6	306	7	6.1	6.1
2		449	4	326	3	449	4	326	3	408	4	0	9.1
3		408	4.5	306	3	408	4.5	204	3	286	4.5	33.3	29.9
4		326	5	326	4	326	5	245	4	244	5	24.8	25.0
5		306	6	326	6	306	6	326	6	306	6	0	0
6		408	5	326	4	408	5	–	–	–	–	–	–
7		408	5	306	4	326	5	245	4	391	5	19.9	20.0
8		410	5	408	5	410	5	367	5	451	5	10.0	10.0
9		408	7	306	6	306	7	204	6	204	7	33.3	33.3
10		408	4	326	3	490	4	224	3	337	4	31.3	31.3
11		490	4	326	3	490	4	306	3	460	4	6.1	6.1
12		367	3	408	3	367	3	408	3	367	3	0	0
13		326	6	306	6	306	6	286	6	286	6	6.5	6.5
14		408	6	326	5	408	6	245	5	302	6	24.8	26.0
15		326	4	326	4	326	4	326	4	326	4	0	0
16		326	3.5	306	3	367	3.5	306	3	367	3.5	0	0
17		326	4	326	4	326	4	122	4	122	4	62.6	62.6
18		326	4	326	4	326	4	306	4	346	4	6.3	6.0
19		326	5	245	5	245	5	122	5	122	5	50.2	50.2
20		326	7	306	6	306	7	255	6	255	7	16.7	16.7
21		408	6	360	5	400	6	350	5	388	6	2.7	3.0
22		367	4	520	4	367	4	480	4	337	4	7.7	8.1
23		367	3	449	3	367	3	449	3	367	3	0	0
24		306	4	408	4	306	4	408	4	306	4	0	0
25		326	7	321	5	326	7	300	5	305	7	6.2	6.4
26		300	7	300	6	300	7	300	6	300	7	0	0
27		388	5	326	4	393	5	305	4	285	5	6.4	6.5
28		408	4	360	3	412	4	340	3	389	4	5.6	5.6
29		306	7	320	7	300	7	310	7	280	7	6.3	6.7
30		367	5	319	4	367	5	309	4	355	5	3.1	3.1
INSP. BY													

I.

		Pre Condition		Post Burn in				Life Test				Δ	
		P_{om} @ Im 65ns, 10KHZ F 2.5 55°c	Im @ 55°c, 65ns 10KHZ	P_{om} @65ns, 10KHZ F2.5 25°c After 17 Hr Burn In	Im @ 25°c After 17 hr Burnin	P_{om} @Im, 65ns, 10KHZ F 2.5 55°c After 17 hr Burnin	Im @55°c After 17hr Burnin	P_{om} @ Im 65ns, 10KHZ F 2.5 25°c After 100 hrs	Im @25°c After 100hrs	P_{om} @ Im 65ns, 10KHZ F 2.5 55°c After 100 hrs	Im @ 55°c After 100 hrs	Δ P_{om} @ 25°c After Life Test max Δ 20%	Δ P_{om} @ 55°c After Life Test max Δ 20%
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	%	%
DATE													
TIME													
31		347	5	360	4	347	5	360	4	347	5	0	0
32		449	4	358	3	449	4	358	3	449	4	0	0
33		367	4	490	4	367	4	490	4	367	4	0	0
34		367	4	440	4	367	4	400	4	333	4	9	9.1
35		306	7	306	7	306	7	306	7	306	7	0	0
36		306	4	399	4	306	4	399	4	306	4	0	0
37		490	4	395	3	490	4	395	3	490	4	0	0
38		306	6	400	6	306	6	400	6	306	6	0	0
39		347	7	397	6	347	7	377	6	329	7	5	5.1
40		300	7	318	5	300	7	318	5	300	7	0	0
41		347	6	306	5	347	6	295	5	335	6	3.6	3.7
42		367	3	515	3	367	3	515	3	367	3	0	0
43		347	4	400	5	347	4	385	5	334	4	3.8	3.7
44		326	5	355	4	326	5	355	4	326	5	0	0
45		306	7	320	6	—	—	—	—	—	—		—
46		306	6	315	6	—	—	—	—	—	—	—	—
47		408	4.5	485	4	408	4.5	485	4	408	4.5	0	0
48		367	4.5	440	4	367	4.5	440	4	367	4.5	0	0
49		347	5	396	5	347	5	396	5	347	5	0	0
50		408	5	455	4	408	5	455	4	408	5	0	0
51		347	5	392	5	347	5	392	5	347	5	0	0
52		490	4	408	3	490	4	408	3	490	4	0	0
53		326	5.5	—	—	—	—	—	—	—	-	-	—
54		367	4	448	4	367	4	448	4	367	4	0	0
55		306	4	395	4	306	4	371	4	288	4	6.1	6.1
56		326	6.5	354	6	326	6.5	324	6	300	6.5	8.6	8.1
57		410	5.5	435	5	—	—	—	—	—	—	—	—
58		300	7	307	7	300	7	307	7	300	7	0	0
59		408	7	326	6	408	7	326	6	408	7	0	0
60		449	4	408	3	449	4	408	3	449	4	0	0
INSP. BY													

II.

		Pre Condition		Post Burnin				Life Test				Δ	
		P_{om} @ Im 65ns, 10KHZ F 2.5 55°C	Im @ 55°C, 65ns 10KHZ	P_{om} @ 65ns, 10KHZ F 2.5 25°C After 17 Hr Burn In	Im @ 25°C After 17 hr Burnin	P_{om} @Im, 65ns, 10KHZ F 2.5 55°C After 17 hr Burnin	Im @ 55°C After 17 hr Burnin	P_{om} @ Im 65ns, 10KHZ F 2.5 25°C After 100 hrs	Im @25°C After 100hrs	P_{om} @ Im 65ns, 10KHZ F 2.5 55°C After 100 hrs	Im @ 55°C After 100 hrs	Δ P_{om} @ 25°C After Life Test max Δ 20%	Δ P_{om} @ 55°C After Life Test max Δ 20%
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	%	%
DATE													
TIME													
61		326	4	428	4	326	4	306	4	233	4	28.5	28.5
62		449	5	245	4	286	5	143	4	167	5	41.6	41.6
63		367	4	449	4	326	4	408	4	296	4	9.1	9.1
64		408	5	326	4	408	5	286	4	358	5	12.3	12.3
65		408	4.5	408	4	408	4.5	367	4	367	4.5	10.0	10.0
66		469	4.5	326	3	469	4.5	286	3	411	4.5	12.3	12.3
67		367	5	326	4	367	5	122	4	137	5	62.6	62.6
68		326	5	306	4	326	5	245	4	261	5	19.9	19.9
69		367	5	408	4	408	5	367	4	363	5	10.0	11.0
70		490	4	367	3	490	4	265	3	354	4	27.8	27.8
71		406	4	367	3	490	4	367	3	490	4	0	0
72		326	4.5	408	4	326	4.5	286	4	229	4.5	29.9	29.9
73		367	6	367	5	367	6	245	5	245	6	33.2	33.2
74		367	3.5	367	3	367	3.5	306	3	301	3.5	16.6	18.0
75		326	4	449	4	326	4	367	4	266	4	18.3	18.3
76		326	4.5	571	4	449	4.5	449	4	353	4.5	21.4	21.4
77		300	7	306	7	300	7	306	7	300	7	0	0
78		408	5	367	4	408	5	265	4	293	5	27.8	26.1
79		367	4	326	3	367	4	286	3	321	4	12.3	12.6
80		326	3.5	408	3	367	3.5	367	3	330	3.5	10.0	10.0
81		367	4.5	306	3	367	4.5	255	3	305	4.5	16.7	16.9
82		367	4	408	4	367	4	326	4	292	4	20.1	20.5
83		410	4	306	3	410	4	214	3	287	4	30.1	30.1
84		428	5	449	4	530	5	367	4	433	5	18.3	18.3
85		367	4	490	4	367	4	428	4	320	4	12.7	12.7
86		449	4	367	3	449	4	326	3	379	4	11.2	11.2
87		326	5	410	5	326	5	204	5	162	5	50.2	50.2
88		410	6	326	5	410	6	184	5	231	6	43.6	43.6
89		326	3	163	3	122	3	122	3	92	3	25.2	25.2
90		408	4	306	3	408	4	204	3	272	4	33.3	33.3
INSP. BY													

II

		Pre Condition		Post Burnin				Life Test				Δ	
		P_{om} @ Im 65ns, 10KHZ F 2.5 55°c	Im @ 55°c, 65ns 10KHZ	P_{om} @ 65ns, 10KHZ F 2.5 25°c After 17 Hr Burn In	Im @ 25°c After 17 hr Burnin	P_{om} @ Im, 65ns, 10KHZ F 2.5 55°c After 17 hr Burnin	Im @ 55°c After 17 hr Burnin	P_{om} @ Im 65ns, 10KHZ F 2.5 25°c After 100 hrs	Im @ 25°c After 100 hrs	P_{om} @ Im 65ns, 10KHZ F 2.5 55°c After 100 hrs	Im @ 55°c After 100 hrs	Δ P_{om} @ 25°c After Life Test max Δ 20%	Δ P_{om} @ 55°c After Life Test max Δ 20%
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	%	%
DATE													
TIME													
91		326	4	326	4	326	4	245	4	243	4	24.8	25.4
92		408	5	326	4	286	5	245	4	214	5	24.8	25.3
93		367	6	245	4	360	6	163	4	237	6	335	34.1
94		300	7	306	7	300	7	306	7	300	7	0	0
95		530	4	490	3	530	4	449	3	484	4	8.4	8.6
96		326	4	469	4	326	4	326	4	227	4	305	30.5
97		408	4	530	4	408	4	449	4	343	4	15.3	16.0
98		408	4	367	3	408	4	286	3	314	4	22.1	23.1
99		428	5	367	4	408	5	326	4	360	5	11.2	11.8
100		408	5	490	4	469	5	400	4	379	5	18.4	19.2
INSP. BY													

		Pre Burn In				Post Burnin				Life Test			
		P_{om} @ I_m 75ns, 5 KHZ F 2.5 25°C	I_m @ 25°C	P_{om} @ I_m, 75ns, 5KHZ F 2.5 55°C	I_m @ 55°C	P_{om} @ I_m 75ns 5KHZ F2.5 25°C After 17hr Burnin	I_m @ 25°C After 17hr Burnin	P_{om} @ I_m 75ns, 5KHZ F2.5, 55°C After 17hr Burnin	I_m @ 55°C After 17hr Burnin	P_{om} @ I_m 75ns, 5KHZ F2.5, 25°C After 100hr Life	I_m @ 25°C After 100hr Life	P_{om} @ I_m 75ns, 5KHZ F2.5 55°C After 100hr Life	I_m @ 55°C After 100 hr Life
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps
DATE													
TIME													
1		326	7	367	10	326	7	367	10	286	7	300	10
2		530	4	408	4	530	4	408	4	530	4	408	4
3		367	4	367	5	367	4	367	5	286	4	256	5
4		449	6	408	7	449	6	408	7	306	6	300	7
5		367	7	326	8	367	7	326	8	367	7	326	8
6		—	—	—	—	—	—	—	—	—	—	—	—
7		388	6	367	7	388	6	367	7	306	6	300	7
8		469	6	408	6	469	6	408	6	367	6	326	6
9		286	7	204	7	286	7	204	7	245	7	185	7
10		408	4	449	5	408	4	449	5	245	4	224	4
11		459	4	408	5	459	4	408	5	367	4	306	5
12		408	3	449	4	408	3	449	4	408	3	449	4
13		326	7	408	10	326	7	408	10	224	7	306	10
14		326	6	367	7	326	6	367	7	224	6	250	7
15		408	5	367	6	408	5	367	6	204	5	157	6
16		367	3	408	4	367	3	408	4	367	3	408	4
17		286	7	245	7	286	7	245	7	—	—	—	—
18		367	5	367	6	367	5	367	6	265	5	265	6
19		245	7	245	10	245	7	245	10	—	—	—	—
20		286	7	240	10	286	7	240	10	163	7	121	10
21		408	7	408	8	408	7	408	8	383	7	382	8
22		428	5	490	6	428	5	490	6	400	5	459	6
23		408	3	449	3.5	408	3	449	3.5	408	3	449	3.5
24		408	4	449	5	408	4	449	5	408	4	449	5
25		326	7	408	10	326	7	408	10	326	7	408	10
26		363	7	367	8	363	7	367	8	363	7	367	8
27		367	5	367	6	367	5	367	6	367	5	367	6
28		408	4	490	5	408	4	490	5	408	4	490	5
29		367	7	367	8	367	7	367	8	367	7	367	8
30		326	6	408	8	326	6	408	8	326	6	408	8
INSP. BY													

7L

		Pre Burn In				Post Burnin				Life Test			
		P_{om} @ Im 75ns, 5KHZ F 2.5 25°C	Im @ 25°C	P_{om} @ Im, 75ns, 5KHZ F 2.5 55°C	Im @ 55°C	P_{om} @ Im 75ns 5KHZ F 2.5 25°C After 17hr Burnin	Im @ 25°C After 17hr Burnin	P_{om} @ Im 75ns, 5KHZ F 2.5, 55°C After 17hr Burnin	Im @ 55°C After 17hr Burnin	P_{om} @ Im 75ns, 5KHZ F 2.5, 25°C After 100hr Life	Im @ 25°C After 100hr Life	P_{om} @ Im 75ns, 5KHZ F 2.5 55°C After 100hr Life	Im @ 55°C After 100hr Life
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps
DATE													
TIME													
31		326	5	326	6	326	5	326	6	326	5	326	6
32		530	4	408	4	530	4	408	4	530	4	408	4
33		449	4	367	4	449	4	367	4	449	4	367	4
34		367	5	367	6	367	5	367	6	367	5	367	6
35		326	1	367	3	326	7	367	8	326	1	367	3
36		367	4	408	5	367	4	408	5	367	4	408	5
37		571	4	408	4	571	4	408	4	571	4	408	4
38		408	6	367	6	408	6	367	6	408	6	367	6
39		367	7	326	8	367	7	326	8	367	7	326	8
40		367	7	367	8	367	7	367	8	367	7	367	8
41		326	6	367	7	326	6	367	7	300	6	337	7
42		449	3	510	4	449	3	510	4	449	3	510	4
43		408	6	408	7	408	6	408	7	408	6	408	7
44		408	5	449	6	408	5	449	6	408	5	449	6
45		—	—	—	—	—	—	—	—	—	—	—	—
46		—	—	—	—	—	—	—	—	—	—	—	—
47		408	4	408	5	408	4	408	5	408	4	408	5
48		490	5	367	5	490	5	367	5	490	5	367	5
49		449	6	408	6	449	6	408	6	449	6	408	6
50		530	5	408	5	530	5	408	5	530	5	408	5
51		326	6	408	9	326	6	408	9	326	6	408	9
52		469	4	326	4	469	4	326	4	326	4	469	4
53		—	—	—	—	—	—	—	—	—	—	—	—
54		367	4	449	5	367	4	449	5	367	4	449	5
55		408	5	449	6	408	5	449	6	408	5	449	6
56		306	7	367	9	306	7	367	9	306	7	367	9
57		—	—	—	—	—	—	—	—	—	—	—	—
58		326	7	367	8	326	7	367	8	326	7	367	8
59		367	4	367	5	367	4	367	5	367	4	367	5
60		367	3	449	4	367	3	449	4	367	3	449	4
INSP. BY													

III

		Pre Burn In				Post Burnin				Life Test			
		P_{om} @ I_m 75ns, 5KHZ F2.5 25°C	I_m @ 25°C	P_{om} @ I_m, 75ns, 5KHZ F2.5 55°C	I_m @ 55°C	P_{om} @ I_m 75ns 5KHZ F2.5 25°C After 17hr Burnin	I_m @ 25°C After 17hr Burnin	P_{om} @ I_m 75ns, 5KHZ F2.5, 55°C After 17hr Burnin	I_m @ 55°C After 17hr Burnin	P_{om} @ I_m 75ns, 5KHZ F2.5, 25°C After 100hr Life	I_m @ 25°C After 100hr Life	P_{om} @ I_m 75ns, 5KHZ F2.5 55°C After 100hr Life	I_m @ 55°C After 100hr Life
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps
DATE													
TIME													
61		408	5	449	6	408	5	449	6	306	5	367	6
62		367	6	408	8	367	6	408	8	306	6	326	8
63		408	4	408	5	408	4	408	5	204	4	204	5
64		408	5	449	6	408	5	449	6	204	5	225	6
65		367	4	449	5	367	4	449	5	300	4	326	5
66		449	4	408	4	449	4	408	4	326	4	326	4
67		408	6	408	8	408	6	408	8	300	6	306	8
68		367	5	367	6	367	5	367	6	300	5	306	6
69		326	4	367	5	326	4	367	5	285	4	300	5
70		530	4	406	4	530	4	408	4	424	4	326	4
71		388	3	449	4	388	3	449	4	306	3	326	4
72		449	5	408	6	449	5	408	6	326	5	326	6
73		367	6	367	7	367	6	367	7	306	6	300	7
74		551	4	408	4	551	4	408	4	449	4	300	4
75		388	4	408	5	388	4	408	5	300	4	326	5
76		449	4	449	5	449	4	449	5	326	4	326	5
77		–	–	–	–	–	–	–	–	–	-	–	–
78		408	5	408	6	408	5	408	6	367	5	367	6
79		490	4	367	4	490	4	367	4	308	4	300	4
80		367	3	490	4	367	3	490	4	200	3	307	4
81		449	4	367	5	449	4	367	5	267	4	206	5
82		367	5	367	5	367	5	367	5	300	5	300	5
83		449	4	490	5	449	4	490	5	326	4	367	5
84		408	4	367	5	408	4	367	5	306	4	206	5
85		449	4	408	5	449	4	408	5	267	4	326	5
86		571	4	367	4	571	4	367	4	409	4	226	4
87		367	7	367	5	367	7	367	8	300	7	306	8
88		367	7	367	6	367	7	367	8	206	7	216	8
89		408	7	367	8	408	7	367	8	306	7	306	8
90		449	4	448	5	449	4	448	5	326	4	326	5
INSP. BY													

		Pre Burn In				Post Burnin				Life Test			
		P_{om}@I_m 75ns, 5KHZ F 2.5 25°C	I_m @ 25°C	P_{om}@I_m, 75ns, 5KHZ F 2.5 55°C	I_m @ 55°C	P_{om}@I_m 75ns 5KHZ F2.5 25°C After 17hr Burnin	I_m @25°C After 17hr Burnin	P_{om}@I_m 75ns, 5KHZ F2.5, 55°C After 17hr Burnin	I_m @55°C After 17hr Burnin	P_{om}@I_m 75ns, 5KHZ F2.5, 25°C After 100hr Life	I_m @25°C After 100hr Life	P_{om}@I_m 75ns, 5KHZ F2.5 55°C After 100hr Life	I_m @55°C After 100 hr Life
		mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps	mw	Amps
DATE													
TIME													
91		367	5	367	6	367	5	367	6	306	5	306	6
92		367	5	367	7	367	5	367	7	226	5	206	7
93		408	6	448	8	408	6	448	8	326	6	307	8
94		—	—	—	—	—	—	—	—	—	—	—	—
95		490	3	448	3.5	490	3	448	3.5	367	3	326	3.5
96		490	5	408	6	490	5	408	6	307	5	326	6
97		367	4	367	4	367	4	367	4	206	4	206	4
98		551	4	490	5	551	4	490	5	408	4	308	5
99		490	5	448	6	490	5	448	6	408	5	300	6
100		408	4	408	5.5	408	4	408	5.5	326	4	285	5.5
INSP. BY													

IV:

		Δ											
		Δ P_{om} @ 25°C max Δ 20%	Δ P_{om} @ 55°C max Δ 20%	λ @ 25°C, I_m 65mA, 10KHZ	λ @ 25°C, I_m 75mA, 5KHZ								
		%	%	nm	nm								
DATE													
TIME													
1		12.3	18.3	850	852								
2		0	0	850	852								
3		22.1	22.1	850	851								
4		31.8	26.5	853	854								
5		0	0	851	853								
6		—		—	—								
7		21.2	18.3	853	854								
8		21.7	20.1	854	855								
9		14.4	9.4	854	856								
10		40.0	50.1	851	853								
11		20.1	25.0	852	854								
12		0	0	853	854								
13		31.3	25.0	855	857								
14		31.3	31.9	850	852								
15		50.1	58.9	854	855								
16		0	0	851	852								
17		—	—	—	—								
18		27.8	27.8	851	853								
19		—	—	—	—								
20		43.6	50.6	850	852								
21		6.1	6.3	854	855								
22		6.5	6.3	851	853								
23		0	0	851	852								
24		0	0	850	851								
25		0	0	852	854								
26		0	0	853	855								
27		0	0	851	853								
28		0	0	851	853								
29		0	0	855	857								
30		0	0	850	851								
INSP. BY													

IV

		Δ											
		Δ P_{om} @ 25°C max Δ 20%	Δ P_{om} @ 55°C max Δ 20%	λ @ 25°C, I_m 65ns, 10KHZ	λ @ 25°C, I_m 75ns, 5KHZ								
		%	%	nm	nm								
DATE													
TIME													
31		0	0	851	853								
32		0	0	851	852								
33		0	0	853	855								
34		0	0	854	856								
35		0	0	855	856								
36		0	0	853	855								
37		0	0	850	852								
38		0	0	851	852								
39		0	0	851	853								
40		0	0	850	852								
41		7.9	8.1	853	855								
42		0	0	854	855								
43		0	0	854	856								
44		0	0	853	855								
45		—	—	—	—								
46		—	—	—	—								
47		0	0	853	855								
48		0	0	851	853								
49		0	0	851	853								
50		0	0	850	852								
51		0	0	852	854								
52		0	0	853	854								
53		—	—	—	—								
54		0	0	853	855								
55		0	0	850	852								
56		0	0	854	856								
57		—	—	—	—								
58		0	0	855	856								
59		0	0	851	853								
60		0	0	852	854								
INSP. BY													

IV-

		Δ											
		Δ P_{om} @ 25°C max Δ 20%	Δ P_{om} @ 55°C max Δ 20%	λ @ 25°C, Im 65ns, 10KHz	λ @ 25°C, Im 75ns, 5KHz								
		%	%	nm	nm								
DATE													
TIME													
61		25.0	18.3	854	856								
62		16.6	20.1	853	855								
63		50.1	50.0	855	856								
64		50.0	50.0	854	856								
65		18.3	27.4	853	854								
66		27.4	20.1	851	853								
67		26.5	25.0	855	856								
68		18.3	16.6	852	853								
69		12.6	18.3	851	853								
70		21.0	20.2	851	853								
71		21.1	27.4	853	855								
72		27.4	21.2	854	856								
73		16.6	16.3	851	853								
74		18.5	33.6	850	852								
75		22.7	21.1	851	853								
76		27.4	27.5	851	852								
77		—	—	—	—								
78		10.0	10.2	855	856								
79		37.1	24.1	854	856								
80		45.5	37.3	855	857								
81		40.5	43.9	851	853								
82		18.3	18.3	853	855								
83		27.4	25.1	853	854								
84		25.0	43.9	850	851								
85		40.5	20.1	851	853								
86		28.4	38.5	851	852								
87		18.3	18.3	851	853								
88		43.9	41.1	851	852								
89		25.0	16.6	852	855								
90		27.4	27.2	850	853								
INSP. BY													

IV.

		Δ			
		Δ P_{om} @25°C max Δ 20%	Δ P_{om} @55°C max Δ 20%	λ @25°C, Im 65ns, 10KHz	λ @25°C, Im 75ns, 5KHz
		%	%	nm	nm
DATE					
TIME					
91		16.6	16.6		
92		38.4	43.9		
93		20.1	31.5		
94		—	—	—	—
95		25.1	27.2		
96		37.3	27.2		
97		43.9	43.9		
98		26.0	37.1		
99		16.7	33.0		
100		20.1	30.1		
INSP. BY					

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I

		PRE BURNIN				PRE CONDITION							
		Pom @ Im, 65NS, 10KHZ F2.5 25°C	Im @ 25°C, 65NS, 10KHZ	Pom @ Im, 65NS, 10KHZ F2.5 55°C	Im @ 55°C, 65NS, 10KHZ	High temp storage 48hrs. @ 150°C	Pom @ Im, 65NS, 10KHZ F2.5, 25°C	Im @ 25°C, 65NS, 10KHZ	Pom @ Im, 65NS, 10KHZ F2.5, 55°C	Im @ 55°C, 65NS, 10KHZ	Temp. Cycle MIL STAND. 202 METH 102 100°C	Pom @ Im, 65NS, 10KHZ F2.5, 25°C	Im @ 25°C, 65NS 10KHZ
		mW	AMPS	mW	AMPS	P/F	mW	AMPS	mW	AMPS	P/F	mW	AMPS
DATE													
TIME													
1		326	4	336	5	P	326	4	336	5	P	326	4
2		326	7	316	8	P	326	[illegible]	316	8	P	326	7
3		336	5	336	6	P	336	5	336	6	P	336	5
4		326	7	326	10	P	326	7	326	10	P	326	7
5		346	7	346	8	P	346	7	346	8	P	346	7
6		418	6	367	6	P	418	6	367	6	P	418	6
7		326	4	367	5	P	326	4	367	5	P	326	4
8		387	6	367	7	P	387	6	367	7	P	387	6
9		326	4	377	5	P	326	4	377	5	P	326	4
10		326	4	387	6	P	326	4	387	6	P	326	4
11		387	5	420	6	P	387	5	420	6	P	387	5
12		326	6	336	6.5	P	326	6	336	6.5	P	326	6
13		336	6	326	6	P	336	6	326	6	P	336	6
14		336	3	418	4	P	336	[illegible]	418	4	P	336	3
15		367	7	326	7	P	367	7	326	7	P	367	7
16		336	7	367	8	P	336	7	367	8	P	336	7
17		346	7	336	8	P	346	[illegible]	336	8	P	346	7
		326	5	326	6	P	336	5	326	6	P	326	5
		368	5	326	[illegible]	P	368	5	326	5	P	368	5
		326	7	342	7	P	326	7	342	7	P	326	7
		341	5	367	6	P	341	5	367	6	P	341	5
		382	5	382	6	P	382	[illegible]	382	6	P	382	5
		342	4	377	[illegible]	P	[illegible]	4	387	5	P	[illegible]	4
		372	4	[illegible]	5	P	[illegible]	4	[illegible]	5	P	[illegible]	4
		[illegible]	6	412	7	P	[illegible]	[illegible]	412	7	P	[illegible]	6
INSP. BY													

		PRE Condition		Post BURN IN				LIFE TEST				Δ	
		P_{OM} @ I_M, 65NS, 10KHZ F2.5, 55°C	I_M @ 55°C, 65NS, 10KHZ	P_{OM} @ 65NS, 10KHZ, F2.5 25°C AFTER 17hr BURN IN	I_M @ 25°C AFTER 17hr. BURN IN	P_{OM} @ I_M, 65NS, 10KHZ, F2.5, 55°C AFTER 17hr. BURN IN	I_M @ 55°C AFTER 17hr BURN IN	P_{OM} @ I_M, 65NS, 10KHZ, F2.5, 25°C AFTER 100hrs.	I_M @ 25°C AFTER 100hrs.	P_{OM} @ I_M, 65NS, 10KHZ, F2.5, 55°C AFTER 100hrs.	I_M @ 65°C AFTER 100hrs.	Δ P_{OM} @ 25°C AFTER LIFE TEST MAX. Δ20%	Δ P_{OM} @ 55°C AFTER LIFE TEST MAX. Δ20%
		mW	AMPS	mW	AMPS	mW	AMPS	mW	AMPS	mW	AMPS	%	%
DATE													
TIME													
1		336	[illegible]	306	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	0	0
2		316	8	[illegible]	7	[illegible]	8	306	7	306	8	0	0
3		336	6	[illegible]	5	326	6	[illegible]	5	326	6	0	0
4		326	10	306	7	306	10	306	7	306	10	0	0
5		346	8	326	7	326	8	[illegible]	7	326	8	0	0
6		367	6	408	6	347	6	408	6	347	6		0
[illegible]		367	[illegible]	306	[illegible]	347	[illegible]	[illegible]	[illegible]	347	5	[illegible]	0
[illegible]		317		[illegible]	7	347	[illegible]	[illegible]	[illegible]	347	7	[illegible]	0
[illegible]		377	[illegible]	306	[illegible]	367	[illegible]	[illegible]	[illegible]	367	[illegible]	0	0
10		[illegible]		[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]	367	[illegible]	0	0
[illegible]		430	[illegible]	367	[illegible]	410	6	[illegible]	[illegible]	410	6	0	[illegible]
[illegible]		336	6.5	[illegible]	7	326	6.5	[illegible]	6	326	6.5	0	[illegible]
[illegible]		326		[illegible]	[illegible]	306	6	[illegible]	6	306	[illegible]	[illegible]	[illegible]
14		418	[illegible]	326	7	408	4	326	[illegible]	408	4	[illegible]	[illegible]
15		326	7	[illegible]	7	306	7	[illegible]	7	306	[illegible]	[illegible]	[illegible]
16		367	8	[illegible]	7	347	8	326	7	347	8	[illegible]	[illegible]
17		336	8	326	7	326	8	[illegible]	7	326	7	[illegible]	[illegible]
[illegible]		336	[illegible]	326	5	326	5	326	[illegible]	26	6	[illegible]	0
[illegible]		326	5	[illegible]	5	306	5	367	[illegible]	[illegible]	5	0	0
[illegible]		342	7	367	7	326	7	367	7	326	7	0	0
[illegible]		367	6	326	5	367	6	326	[illegible]	367	6	0	0
		[illegible]	6	367	5	367	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
		[illegible]	6	326	4	367	5	[illegible]	[illegible]	367	[illegible]	0	0
		[illegible]	[illegible]	326	4	[illegible]	5	[illegible]	[illegible]	326	[illegible]	0	0
[illegible]		[illegible]	7	[illegible]	6	408	7	[illegible]		408	7	0	0
INSP. BY													

31

		PRE BURN IN				Post Burn in				LIFE TEST			
		P_{OM} @ I_M, 75NS, 5KHZ, F2.5, 25°C	I_M @ 25°C	P_{OM} @ I_M, 75NS, 5KHZ, F2.5, 55°C	I_M @ 55°C	P_{OM} @ I_M, 75NS, 5KHZ, F2.5 25°C AFTER 12hr. BURN IN	I_M @ 25°C AFTER 12hr. BURN IN	P_{OM} @ I_M, 75NS, 5KHZ F2.5, 55°C AFTER 12hr. BURN IN	I_M @ 55°C AFTER 12hr BURN IN	P_{OM} @ I_M, 75NS, 5KHZ, F2.5, 25°C AFTER 100HRS. LIFE	I_M @ 25°C AFTER 100HR. LIFE	P_{OM} @ I_M 75NS, 5KHZ, F2.5 55°C AFTER 100HR. LIFE	I_M @ 55°C AFTER 100HR. LIFE
		mW	AMPS	mW	AMPS	mW	AMPS	mW	AMPS	mW	AMPS	mW	AMPS
DATE													
TIME													
[illegible]		[illegible]	11	[illegible]									
[illegible]		[illegible]	[illegible]	226	8								
		[illegible]	[illegible]	262	[illegible]			[illegible]	[illegible]	[illegible]			
[illegible]		[illegible]		[illegible]	[illegible]								
[illegible]		[illegible]	[illegible]	[illegible]	8					[illegible]			
[illegible]		[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]			
		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]		
		[illegible]	[illegible]	[illegible]	[illegible]								
		[illegible]	[illegible]	[illegible]	[illegible]								
[illegible]		[illegible]		[illegible]									
[illegible]		[illegible]			[illegible]								
11		[illegible]		[illegible]	[illegible]	[illegible]							
12				[illegible]									
[illegible]				[illegible]	7			[illegible]					
[illegible]		[illegible]	[illegible]	[illegible]	5			[illegible]			[illegible]		
[illegible]		[illegible]	7	267	7	[illegible]		[illegible]	[illegible]	[illegible]			
[illegible]				[illegible]	7	[illegible]							
		[illegible]	[illegible]	226		226	1	[illegible]					
		[illegible]	[illegible]	226		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]		267	7	[illegible]	[illegible]	267	7	[illegible]	[illegible]	267	[illegible]	[illegible]	
		[illegible]		267	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	267	[illegible]	[illegible]	
		267	[illegible]	[illegible]		267	[illegible]	[illegible]	[illegible]	226		267	[illegible]
			[illegible]	267	[illegible]	[illegible]	11	267	[illegible]	267	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		267	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	226	[illegible]		[illegible]
						[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	7
INSP. BY													

IV

		Δ											
		Δ Pom @ 25°C MAX. Δ 20%	Δ Pom @ 55°C MAX Δ 20%	λ @ 25°C, I_M, 65NS, 10KHZ 850NM $^{+10}_{-20}$	λ @ 25°C, I_M, 75NS, 5KHZ, 850NM $^{+10}_{-20}$								
		%	%	NM	NM								
DATE													
TIME													
1		[illegible]	[illegible]	852	[illegible]								
2		[illegible]		854	[illegible]								
3		[illegible]	[illegible]	852	[illegible]								
4		[illegible]	[illegible]	850	851								
5		[illegible]	[illegible]	852	[illegible]								
6			[illegible]	852	[illegible]								
[illegible]			[illegible]	854	[illegible]								
			[illegible]	851	[illegible]								
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]								
		[illegible]	[illegible]	[illegible]	[illegible]								
[illegible]				854	[illegible]								
[illegible]		[illegible]		852	[illegible]								
[illegible]		[illegible]		854	[illegible]								
		[illegible]		856	[illegible]								
		1		852	[illegible]								
[illegible]			[illegible]	852									
[illegible]		1	1	852									
		[illegible]	0	852	[illegible]								
		[illegible]	[illegible]	854	[illegible]								
		[illegible]		852	[illegible]								
		[illegible]	[illegible]	852	[illegible]								
[illegible]		[illegible]	[illegible]	852	854								
			[illegible]	851	[illegible]								
		1	[illegible]	852	854								
INSP. BY													

American Electronic Laboratories, Inc.
A Subsidiary of AEL Industries, Inc.
P O Box 552, Lansdale, PA 19446 ● Telephone 215-822-2929 ● TWX 510-661-4976 ● Cable AMERLAB

March 3, 1980

ser Diode Labs, Inc.
30 Somerset Street
w Brunswick, NJ 08901

tention: Mr. Steve Lerner Test Report No. 80-477PT

eference: Laser P.O. No. 9686
AEL Control No. 80-373-0429

Dear Mr. Lerner:

This letter certifies the completion of the testing identified as one (1) Lot of (100) One-Hundred, TO-18 Laser Diodes. The test performed was:

TEMPERATURE CYCLING: MIL-STD-202, Method 102, Condition B.

RESULTS: All of the Laser Diodes passed the above test. There was no evidence of physical damage as a result of the test.

Copies of the test log is attached to and form a part of this report. This test was performed by the Product Testing Laboratory of American Electronic Laboratories, Inc., Richardson Road, Montgomeryville, PA 18936. All Diodes were returned to Laser Diode Labs., Inc., after completion of testing on 5 February 1980.

Very truly yours,

AMERICAN ELECTRONIC LABORATORIES, INC.

Paul J. Riley, P.E.
Director, Product Testing
and Service Division

PJR/lm
Encl.

AEL is certified under DLAM 8200.2 page 4-7, Paragraph 4-302F to perform the test reported herein without the direct Government QAR surveillance.

EQUIPMENT LIST

EQUIPMENT	MANUFACTURER	MODEL NO.	AEL NO.	CAL DUE DATE
Temperature Oven	Blue M	OV 490A-2	9785	Each Use
Temperature Chamber	Conrad	TP2401-1	7348	Each Use
Thermocouple Indicator	Doric	400	9999	2[illegible] Feb. 8[illegible]

The above equipment has been calibrated by standards which are regularly calibrated and whose accuracies are traceable to the NATIONAL BUREAU OF STANDARDS.

AEL AMERICAN ELECTRONIC LABORATORIES Inc

PRODUCT TESTING LABORATORY TEST LOG

JOB NO 17525-0429 CUSTOMER Laser Diode PO NO 7676

TEST ENGINEER TEST TECH LK GSI/WITNESS

PRODUCT DESCRIPTION (Model No., Type, Ser. No., Quantity, Etc.) 100 - TO-18 Lasers

TEST DESCRIPTION (Vib., Shock, Etc.) Temp Cycling

TEST PROC Mil. Std. 202- Med 102 Cond B Temp +100°C

DATE	TIME	EVENT DESCRIPTION
2/4/80		Set up 2 Chambers one +100°C one -55°C
		Lasers to see 5 Cycles
	0750	Lasers into Heat
	0825	ambient
	0840	Lasers into Cold
	0910	ambient
	0925	Lasers into Heat
	0955	ambient
	1010	Lasers into Cold
	1040	ambient
	1055	Lasers into Heat
	1125	ambient
	1140	Lasers into Cold
	1210	ambient
	1227	Lasers into Heat
	1257	ambient
	1317	Lasers into Cold
	1347	ambient
	1407	Lasers into Heat
	1437	ambient
	1453	Lasers into Cold
	1527	ambient
		End of Temp Cycling

American Electronic Laboratories, Inc.
A Subsidiary of AEL Industries, Inc.
P O Box 552, Lansdale, PA 19446 • Telephone 215 822 2929 • TWX 510-661-4976 • Cable AMERLAB

April 22, 1980

Laser Diode Labs. Inc.
1130 Somerset Street
New Brunswick, NJ 08901

Attention: Mr. Steve Lerner

Test Report No. 81-52PT

Reference: Laser P.O. No. 1017
AEL Control No. 81-036-1132

Dear Mr. Lerner:

This letter certifies the performance of the testing identified as one (1) Lot of (30) thirty, TO-5 Laser Diodes. The test performed was:

TEMPERATURE CYCLING: MIL-STD-202E, Method 102A, Condition B: Except maximum temperature was 100°C.

RESULTS: All of the Laser Diodes passed the above test. There was no evidence of physical damage as a result of the test.

Copies of the test log are attached to and form a part of this report. This test was performed by the Product Testing Laboratory of American Electronic Laboratories, Inc., Richardson Road, Montgomeryville, PA 18936. All Diodes were returned to Laser Diode Labs., Inc., after completion of testing on 21 March 1980.

Very truly yours,

AMERICAN ELECTRONIC LABORATORIES, INC.

John V. Hathaway

John V. Hathaway, Operations Engineer
Product Testing Laboratory

JVH/lm
Encl.

EQUIPMENT LIST

EQUIPMENT	MANUFACTURER	MODEL NO.	AEL NO.	CAL DUE DATE
Temperature Oven	Blue M	OV 490A-2	8734	Each Use
Temperature Chamber	Conrad	TR24D1-1	7348	Each Use
Thermocouple Indicator	Doric	400	9999	6 Sept. 80

The above equipment has been calibrated by standards which are regularly calibrated and whose accuracies are traceable to the NATIONAL BUREAU OF STANDARDS.

REPORT NO 81-52PT

PAGE 1 OF 1 PAGES

AEL AMERICAN ELECTRONIC LABORATORIES Inc

PRODUCT TESTING LABORATORY TEST LOG

OB NO. 17525-1132 CUSTOMER Laser PO NO 1017

TEST ENGINEER JWH TEST TECH [illegible] GOV WITNESS N.A.

PRODUCT DESCRIPTION (Model No., Type, Ser. No., Quantity, Etc.) 30 - Lasers

TEST DESCRIPTION (Vib., Shock, Etc.) Temp Cycling

TEST PROC. Mil STD 202 - Med 102B

DATE	TIME	EVENT DESCRIPTION
3/21/80		Set up 2 chambers one ~~[illegible]~~ 100°C one
		-55°C
		30 min Cold -55°C, 15 min ambient, 30 min
		+100°C Hot, 5 cycles
	0930	Lasers into cold
	1000	Lasers at ambient
	1015	Lasers into hot
	1045	Lasers at ambient
	1100	Lasers into cold
	1130	Lasers at ambient
	1145	Lasers into hot
	1215	Lasers at ambient
	1230	Lasers into Cold
	1300	Lasers at ambient
	1315	Lasers into hot
	1345	Lasers at ambient
	1400	Lasers into Cold
	1430	Lasers at ambient
	1445	Lasers into hot
	1515	Lasers at ambient
	1530	Lasers into Cold
	1600	Lasers at ambient
	1615	Lasers into hot
	1745	Lasers at ambient
		End of 5 cycles

PAGE ____ OF ____

INSP.
BY

END

DATE
FILMED

10-83

DTIC